

Estuarine Ecosystem & Mangroves

1. Aquatic Ecosystems

Aquatic ecosystems are ecosystems where plants and animals live in **water**.

Classification of Aquatic Ecosystems

1. Freshwater ecosystems

- Very low salt content (< 5 ppt)
- Examples:
 - **Lentic (still water):** lakes, ponds, swamps
 - **Lotic (running water):** rivers, streams

2. Marine ecosystems

- High salt content (\approx 35 ppt or more)
- Examples: oceans, seas

3. Brackish water ecosystems

- Salt content **between 5–35 ppt**
- Examples: **estuaries, mangroves, salt marshes**

Estuaries and mangroves belong to brackish water ecosystems.

2. Estuarine Ecosystem

What is an Estuary?

An estuary is a **partially enclosed coastal area** where:

- **Freshwater from rivers**
- mixes with
- **Saline seawater**

Examples:

- River mouths
- Coastal bays
- Lagoons
- Deltas

Key Features of Estuaries

- Salinity **keeps changing** (0–35 ppt)
- Strongly influenced by **tides**
- Acts as a **transition zone (ecotone)** between land and sea

- Organisms show **osmoregulation** (adaptation to changing salinity)
- Very **nutrient-rich**

Formation of Estuaries

Estuaries are formed due to:

- Rise in sea level
- Tectonic activity
- Glacial processes
- Sand and sandbar movement

Importance of Estuaries

Estuaries are among the **most productive ecosystems in the world**.

Why?

- Mixing of freshwater and seawater brings **nutrients**
- Supports species from **both marine and freshwater ecosystems**

Major Importance

- Highly productive fishing grounds
- Act as **natural pollution filters**
- Trap sediments → help in **delta formation**
- Mangroves near estuaries protect coasts from **cyclones**
- Buffer between land and sea
- Ideal locations for **ports and harbours**
- Support livelihoods of coastal populations

About **60% of the world's population** lives near coasts and estuaries.

3. Lagoon vs Estuary

Feature	Estuary	Lagoon
Freshwater input	Present	Mostly absent
Water movement	Strong	Sluggish
Salinity	Moderate	Higher
Depth	Deeper	Shallow
Formation	Sea-level rise	Sea-level fall
Indian example	Konkan coast	Kerala backwaters

4. Estuarine Vegetation & Life

- Vegetation depends on **salinity & flooding**

- Includes:
 - Mangroves
 - Salt marshes
 - Seagrasses
 - Mudflats
- Highly dynamic ecosystem

Common organisms:

- Phytoplankton (diatoms, algae)
- Fish, prawns, crabs
- Birds like pelicans
- Sea turtles, sea catfish

5. Estuarine Ecosystem in India

- India has **14 major, 44 medium, and 162 minor rivers**
- Most major estuaries are on the **East Coast**
- West coast estuaries are **smaller but deeper**

Examples:

- East coast: Hooghly, Godavari, Krishna
- West coast: Mandovi, Zuari

Issues in Indian Estuaries

- Industrial & sewage pollution
- Overfishing
- Aquaculture expansion
- Dredging & navigation
- Blocking fish migration routes
- Habitat destruction (Chilika, Pulicat)

6. Mangroves

What are Mangroves?

Mangroves are:

- Salt-tolerant (**halophyte**) trees and shrubs
- Found in **coastal brackish water areas**
- Grow in **intertidal zones** (between land and sea)
- Best example of an **ecotone ecosystem**

Key Characteristics of Mangroves

- Evergreen forests
- Grow in **muddy, oxygen-poor soils**
- Highly productive ecosystems
- Protect coastlines from:
 - Cyclones
 - Tsunamis
 - Coastal erosion

Adaptations of Mangroves (Very Important)

1. **Salt tolerance**
 - Salt-secreting glands
 - Salt exclusion at roots
2. **Special roots**
 - **Prop roots** (Rhizophora)
 - **Pneumatophores** (Avicennia) – for breathing
 - **Stilt roots**
3. **Vivipary**
 - Seeds germinate on the tree itself
 - Helps survival in saline water
4. **Low oxygen adaptation**
 - Roots adapted to anaerobic muddy soil

7. Mangroves in India

Distribution

- India has **~3% of the world's mangroves**
- Mostly along:
 - East coast
 - Andaman & Nicobar Islands
 - Gujarat coast

Major Mangrove Regions in India



1. Sundarbans (West Bengal)

- The largest mangrove forest in the world
- Home to the **Royal Bengal Tiger**
- Formed by Ganga–Brahmaputra delta

2. Bhitarkanika (Odisha)

- Second largest mangrove forest in India

- High biodiversity

3. Godavari–Krishna Delta (Andhra Pradesh)

- Dense mangrove swamps

4. Pichavaram & Vedaranyam (Tamil Nadu)

- Degraded due to aquaculture & salt pans

5. Gujarat (Gulf of Kutch)

- Dominant species: Avicennia
- Scrubby and dwarf mangroves
- Improving condition (Kori Creek)

6. Andaman & Nicobar Islands

- Dense, diverse, undisturbed mangroves

8. Importance of Mangroves

Ecological Importance

- Prevent coastal erosion
- Reduce the impact of cyclones & tsunamis
- Act as carbon sinks
- Support marine biodiversity

Economic & Social Importance

- Fish breeding & nursery grounds
- Livelihoods for coastal communities
- Source of timber, fuelwood, and medicines

9. Threats to Mangroves

- Conversion to agriculture & aquaculture
- Urbanisation & industrialisation
- Oil spills
- Pollution
- Climate change & sea-level rise